

PALEONTOLOGY.—Notes on *Texacrinus*. HARRELL L. STRIMPLE, Bartlesville, Okla. (Communicated by Alfred R. Loeblich, Jr.)

The author was first aware of the presence of crinoids in the Francis shale of southeastern Oklahoma with the description of *Oklahomacrinus loeblichii* Moore (1939). The specimen involved was somewhat fragmentary and did not indicate particularly lucrative collecting possibilities. Richard Alexander, at present a student at the University of Oklahoma, called my attention to the potentialities of the horizon as exposed in the brick pit just south of Ada, Okla., which is the type locality of *O. loeblichii*. Before an expedition was arranged, he and Allen Graffham, of Carter Oil Co., explored the exposed zones more thoroughly. Mr. Graffham was cognizant of special techniques needed to remove shale blocks and subsequently to expose the specimens. One fairly large pocket proved to be especially prolific in crinoid calices and crowns. It was somewhat comparable to famous crinoid "nests" of Crawfordsville, Ind., Le Grand or Gilmore City, Iowa, or Huntsville, Ala.; however, there was no associated limestones, and preservation was therefore not so perfect. Most of the material available for study was collected individually and collectively by Allen Graffham, Richard Alexander, Claude Bronaugh, and the author. Considerable time and effort have been spent in excavating the shale blocks, especially from the large colony. A thin layer of carbonaceous vegetal material marks the top of the 3- to 4-inch crinoid zone and a jumbled mass of isolated columnals and shells mark the bottom. Other smaller "nests" have been discovered at somewhat lower horizons, but the specimens are more difficult to prepare.

In the present paper an effort is made to record several new species from the Francis shale which are assigned to *Texacrinus* Moore and Plummer (1940), as well as two species from lower and higher horizons. Heretofore only one species had been described, *T. gracilis* Moore and Plummer (1940), which is the genotype species. The holotype and only specimen known at that time was a magnificent crown from the Des Moines formation of Texas, but the cup is somewhat distorted owing to lateral compression and

the exact nature of the base is not known. It was interpreted, and probably correctly, by these authors that the cup had a slightly depressed base. The author has also collected a crown from the same horizon in Texas but unfortunately the lower portion of the cup is missing and if present would have been compressed in the same manner as the holotype.

A new form from the Des Moines of Oklahoma is presented as *T. associatus*, n. sp. It has a broader cup with a wider basal area than normal for the genus.

Three new species are presented from the Missouri: *T. interruptus*, *T. irradiatus*, and *T. compactus*. The first two are robust, with unusually large columnals, relatively high dorsal cups, and IBB entirely covered by the proximal columnals. *T. interruptus* is distinctive in having circular depressions at the angles of the plates and strong tumidity of cup plates. The presence of these depressions, and subsequently raised areas along the sutures, is considered by the author and others as a significant specialization which is in some instances of generic importance. *T. compactus* has an unusually small stem and a more compact cup than the other species from the Francis shale.

One species is described as *T. progressus* from the Virgil series of northeastern Oklahoma. It discloses a progressive step toward elimination of the anal plates from the dorsal cup and is the only known representative of the genus to show any appreciable change in this respect.

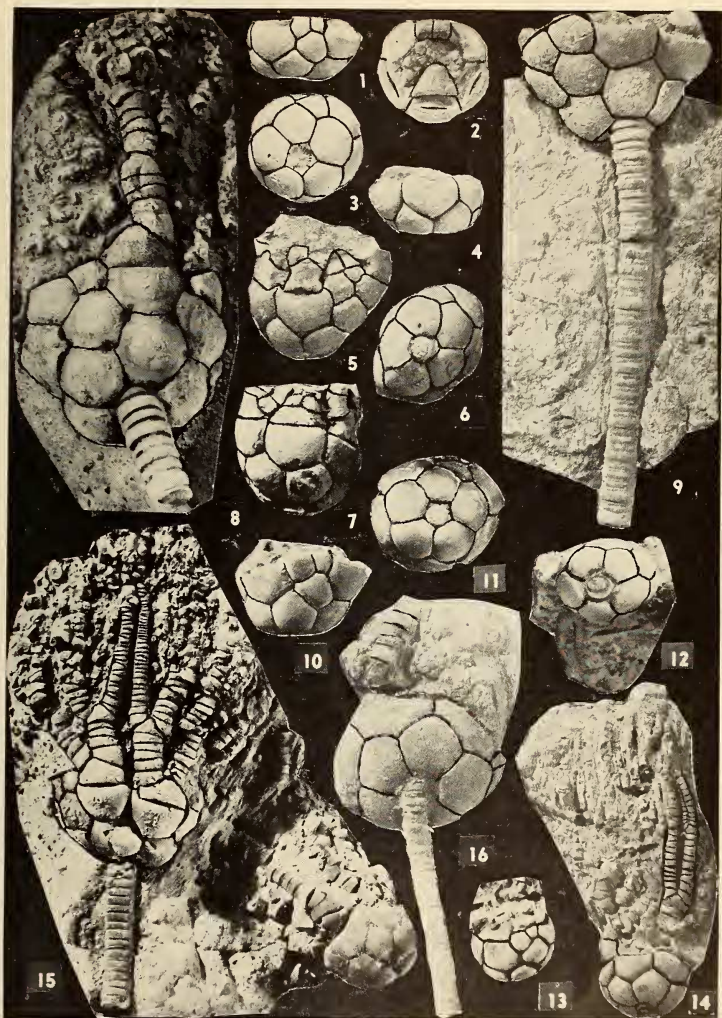
The author believes there is a close affinity to *Haerteocrinus* Moore and Plummer (1940), but this matter will be discussed at length in a later paper.

Genus *Texacrinus* Moore and Plummer

*Texacrinus interruptus*, n. sp.

Fig. 8

Dorsal cup has the form of a medium, basally impressed globe. All sutures are impressed, and deep round depressions are found at the angles of the plates. Infrabasals (IBB) are entirely within the basal concavity and are covered by the proxi-



FIGS. 1-4.—*Texacrinus associatus*, n. sp.: Holotype from posterior, summit, base, and anterior  $\times 2$ . FIGS. 5-7.—*Texacrinus progressus*, n. sp.: Holotype from left posterior, base, and right anterior  $\times 2$ . FIG. 8.—*Texacrinus interruptus*, n. sp.: Holotype from the right posterior,  $\times 2$ . FIGS. 9, 12-15.—*Texacrinus irradiatus*, n. sp.: 9, Large paratype from right posterior,  $\times 1.3$ ; 12-14, young paratype from base,  $\times 2.7$ , posterior and anterior,  $\times 2$ ; 15, holotype from right posterior (a specimen of *Aesioerinus* sp. is also shown),  $\times 1.2$ . FIGS. 10, 11, 16.—*Texacrinus compactus*, n. sp.: 10, 11, Holotype from posterior and base,  $\times 2$ ; 16, paratype from anterior,  $\times 2.3$ .

mal columnals. Basals (BB) are five large tumid plates which curve strongly out of the depressed base and form an appreciable portion of the lateral calyx walls. Radials (RR) are five medium plates which are tumid and have articulating facets which do not fill their distal faces. Three tumid anal plates occupy the posterior interradius (post. IR). The radianal (RA) is unusually large, rests obliquely on the upper surface of post. B, and supports anal X and RX to the right and left above. Anal X is considerably larger than RX but the upper surfaces of the two plates form a common plane, above the distal extremities of the dorsal cup.

Complete arm structure is not known for this species. Axillary first primibrachials (PBrBr) are present in several rays. They are low, tumid elements. The following SBrBr are rather large and cuneiform, with well-rounded exteriors.

Sixteen or more columnals are preserved and show the unusually robust nature of the stem. A thin small columnal is succeeded by, and sharply defined from, a large thick columnal.

Measurements (in mm).—

	Holotype
Width of dorsal cup	17.5
Height of dorsal cup	10.5
Diameter of expanded proximal columnals	3.8
Length of l. post. B*	7.3
Width of l. post. B*	6.0
Length of l. post. R*	5.0
Width of l. post. R*	7.9
Length of suture between BB	3.7
Length of suture between RR	2.8

\* Along surface curvature.

Remarks.—This species is more comparable to *T. irradiatus* than other described species and is readily distinguished by the strong tumidity of the cup plates, sharp definition between the alternately expanded columnals, and depressions at the angles of the cup plates.

Occurrence and horizon.—Upper part of the Francis shale, Missouri series, Pennsylvanian; section 4, T. 3 N., R. 6 E., brick pit south of Ada, Okla.

Types.—Holotype collected by the author. To be deposited in the U. S. National Museum.

*Texacrinus irradiatus*, n. sp.

Figs. 9, 12-15

Dorsal cup is in the form of a medium, basally impressed bowl. IBB are five small plates confined to the basal concavity and are almost entirely covered by the proximal columnals. BB are five large plates which participate strongly in the

lateral walls of the calyx. RR are five large pentagonal plates. The outer surface of the RR continue for a short distance into the interarticulating areas so that the articulating facets do not occupy the full width of the plates. Three large anal plates are present in the post. IR. RA covers the entire upper surface of post. B and is followed above by anal X to the left and RX to the right. Anal X is the larger of the two; however, it forms a common plane with RX. The latter plate occupies a considerably higher position in relation to the basal plane of the cup. All sutures between cup plates are mildly to sharply impressed.

Thirty cuneiform arms are indicated. First PBrBr are axillary in all rays and are low wide elements. Second bifurcation takes place on or about the fifth SBrBr in all rays. Thereafter the outer rays remain unbranched, but a second dichotomy takes place in the inner rays.

The column is round and is composed of alternately expanded columnals. No evidence of cirri has been found. Tegmen is unknown. Crown and column are devoid of ornamentation.

Measurements (in mm).—

	Holotype	Large figured paratype	Small figured paratype
Width of dorsal cup	21.4*	30.0*	7.1
Height of dorsal cup	9.8	15.0	5.0
Diameter of expanded columnals	4.2	6.5	2.3
Width of r. ant. B†	6.5	10.0	4.4
Length of r. ant. B†	7.8	10.2	3.0
Width of r. ant. R†	10.0	12.0	4.5
Length of r. ant. R†	6.5	7.4	2.6
Length of arms (as preserved)	33.2	—	18.3
Length of suture between BB	6.0	6.9	2.2
Length of suture between RR	4.5	4.7	1.8

\* Mildly distorted due to lateral compression.

† Along curvature of plates.

Remarks.—This species is the commonest representative of the genus found in the Francis shale. It is more robust than *T. interruptus*, and comparison is given under description of that species. The small figured paratype is obviously a young representative of the species in that the column remains proportionately large. The arms of the young specimen are more comparable to those of *T. gracilis* in their delicate appearance.

Occurrence and horizon.—Upper part of the Francis shale, Missouri series, Pennsylvanian; section 4, T. 3 N., R. 6 E., brick pit south of Ada, Okla.

Types.—Holotype and figured paratypes collected by Allen Graffham. To be deposited in the U. S. National Museum.

**Texacrinus compactus, n. sp.**

Figs. 10, 11, 16

This species is fairly abundant in the Francis shale and is characterized by the small compact nature of the cup and the comparatively small column. A complete crown has not been found but the dorsal cup is well represented and portions of the arms are known.

Dorsal cup is in the form of a medium, basally impressed truncated cone. IBB are almost entirely covered by the proximal columnals but their outer apices are visible in the shallowly impressed basal area. BB are five rather elongated plates. RR are five pentagonal plates with width slightly greater than length. There are three plates in the post. IR; RA is the largest and separates anal X from post. B, anal X is somewhat larger than RX which is to the right and forms a common plane with anal X in upper extremities.

Column is small and tapers slowly. Although the columnals are alternately expanded there is not the sharp differentiation between small and large segments as found in other species of the genus from the Francis shale.

*Measurements (in mm).—*

	<i>Holotype</i>	<i>Figured paratype</i>
Width of dorsal cup	12.3	13.5
Height of dorsal cup	6.7	5.8
Diameter of expanded proximal columnal	1.7	1.9
Width of r. ant. B*	5.0	5.8
Length of r. ant. B*	5.0	5.8
Width of r. ant. R*	6.0	6.4
Length of r. ant. R*	4.0	4.2
Length of suture between BB	2.5	2.9
Length of suture between RR	1.8	2.0

\* Along surface curvature.

*Remarks.*—The compact nature of the dorsal cup and proportionately small stem distinguish this from other described species.

*Occurrence and horizon.*—Upper part of the Francis shale, Missouri series, Pennsylvanian; section 4, T. 3 N., R. 6 E., brick pit south of Ada, Okla.

*Types.*—Holotype collected by Richard Alexander. Figured paratype collected by the author. To be deposited in the U. S. National Museum.

**Texacrinus progressus, n. sp.**

Figs. 5-7

The dorsal cup has the form of a moderately high truncated globe. There are five IBB in the narrow basal invagination which extend slightly beyond the proximal columnal. Five BB are

elongated elements forming a large portion of the outer cup walls. Five RR are wider than long. The outer surfaces carry into the interarticulating areas for a short distance along the sutures. Plates of the post. IR have an unusual arrangement. RA is large and reaches across the entire upper surface of post. B to make a broad contact with l. post. R. Anal X. is moderately large and extends well above the normal height of the cup. RX is small and is entirely separated from RA by post. R. Distal faces of anal X and RX form a common plane and are each followed by single tube plates of equal size and appearance.

All first PBrBr are axillary. They are mildly constricted in midsection in somewhat the same manner as those of *Apographiocrinus typicalis* Moore and Plummer (1940). They are of unequal length. Only a few SBrBr are preserved and were apparently cuneiform.

Teguen is unknown. Proximal columnals are round, alternatingly expanded and well crenulated.

*Measurements (in mm).—*

	<i>Holotype</i>
Width of dorsal cup	12.3 *
Height of dorsal cup	7.0
Diameter of expanded proximal columnal	2.0
Width of r. ant. B*	5.7
Length of r. ant. B*	6.0
Width of r. ant. R*	6.4
Length of r. ant. R*	4.2
Length of suture between BB	3.0
Length of suture between RR	2.5

\* Along surface curvature.

*Remarks.*—The general appearance of this species is more comparable to *T. compactus* than to other described species. *T. progressus* is readily distinguished by the more advanced arrangement of the anal plates and the slightly elongated axillary PBrBr.

*Occurrence and horizon.*—Nelagony formation, about 35 feet below the Wildhorse limestone member, Virgil series, Pennsylvanian; NW ¼ section 21, T. 22 N., R. 10 E., Osage County, Okla., about 15 miles west of Skiatook.

*Types.*—Holotype collected by Richard Alexander. To be deposited in the U. S. National Museum.

**Texacrinus associatus, n. sp.**

Figs. 1-4

Dorsal cup has the form of a low basally impressed globe. All cup plates are mildly tumid principally due to the impressed sutures. Five IBB form a pentagonal disk at the bottom of the

shallow basal concavity, and are visible beyond the columnar scar. Five BB form a broad basal plane and curve upward to participate in the lateral cup walls. Five RR are wide pentagonal plates. The outer surfaces of RR extend into the interarticulating areas but not in a pronounced manner. Distinctive characters of the articulating facets are the unusually large outer areas where strong outer marginal ridges are found. Ligamental pit furrows are pronounced and transverse ridges are sharp though not prominent. Muscle areas are rather small and slope slightly outwardly.

Three anal plates are present in the post. IR. RA is the larger and has firm contact with l. post. R, anal X, RX, r. post. R, r. post. B and post. B. Anal X is rather small and extends above the distal extremities of the cup. RX is small and forms a common upper plane with anal X.

Proximal columnals are not present but the cicatrix is well defined. Strong crenulations mark the perimeter of the scar and the lumen appears to be rather large and pentalobate.

*Measurements (in mm).—*

	<i>Holotype</i>
Width of dorsal cup .....	11.7
Height of dorsal cup .....	5.1
Diameter of columnar scar .....	2.0
Width of r. ant. B* .....	6.0
Length of r. ant. B* .....	6.0
Width of r. ant. R* .....	7.0
Length of r. ant. R* .....	4.2
Length of suture between BB .....	2.2
Length of suture between RR .....	1.7

\* Along surface curvature.

*Remarks.*—The broad basal plane and low dorsal cup serves to distinguish *T. associatus* from other known species of the genus.

*Occurrence and horizon.*—Oologah limestone (perhaps equivalent to the Altamont limestone of Kansas), Des Moines series, Pennsylvanian; Chandler Materials Company quarry, east of Tulsa, Okla.

*Types.*—Holotype collected by the author. To be deposited in the U. S. National Museum.

#### REFERENCES

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ENTOMOLOGY.—*The Ethiopian genera of Sarginae, with descriptions of new species.* MAURICE T. JAMES, State College of Washington.

The subfamily Sarginae forms a more uniform and homogenous group of flies, over a wide part of the earth's surface, than do the other subfamilies of Stratiomyidae. Collections from the different continents and from major island areas appear surprisingly similar to one another. The wide distribution of such genera as *Microchrysa*, *Ptecticus*, and *Sargus* s.s. is noteworthy. Yet speciation is occurring actively in some areas, and major geographic areas may have their endemic genera. The Ethiopian Region is no exception in this respect.

Eight valid genera have previously been recorded from the Ethiopian Region. These consist of the widely distributed *Sargus*, *Ptecticus*, *Microchrysa*, *Cephalochrysa*, and *Chloromyia* and the three endemic genera *Sagaricera*, *Paraptercticus*, and *Otochrysa*. The last mentioned genus is unknown to me except from its description (Lindner, 1938b, p. 15). Consequently I am unable to place it in the key or to remark further concerning its status. *Parasargus*, proposed by Lindner

(1935, p. 300) for a new species, *P. africanus*, was later reduced by that author (Lindner, 1938b, pp. 13, 14) to the status of a subgenus of *Microchrysa*, and the generotype synonymized with *M. stigmatica* Enderlein. The genus *Chrysochroma* (generotype *Musca bipunctata* Scopoli) is at most a subgenus of *Sargus*, in which the ocelli are equidistant from one another. Many species previously referred to *Chrysochroma* belong in *Cephalochrysa* or other genera of Sarginae. *Chrysochromoides* Brunetti (1926, p. 135), proposed for *C. micropunctata* Brunetti 1926, is unknown to me; Brunetti says it differs from *Chrysochroma* only in the simple third vein. It may be a valid genus or, on the other hand, a synonym of *Cephalochrysa* or *Sargus*.

#### KEY TO THE GENERA OF ETHIOPIAN SARGINAE

1. Eyes densely and distinctly pilose; lower squama well-developed, similar in form to the upper squama ..... *Chloromyia*  
 Eyes bare; lower squama reduced, either transverse or with a relatively slender, straplike projection ..... 2